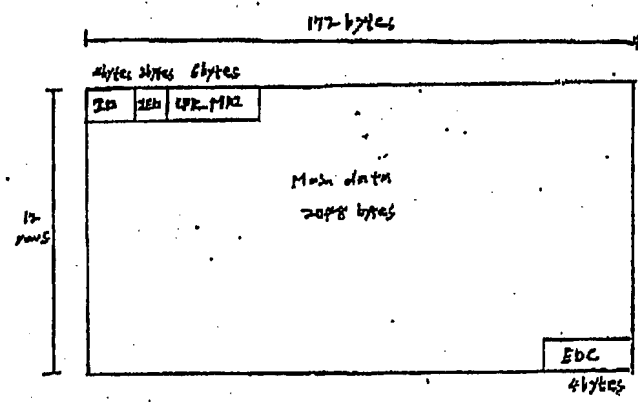




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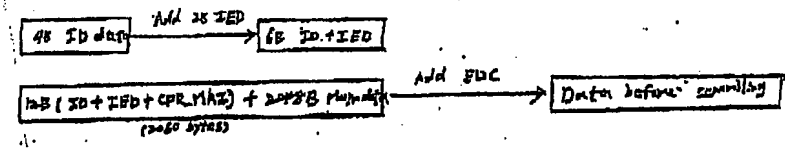
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EDC calculation of DVD Encoding (Error detection code)



$$EDC(x) = \sum_{i=0}^6 b_i x^i$$
$$= I(x) \cdot \{g(x)\}$$
$$I(x) = \sum_{i=0}^{15} b_i x^i$$
$$g(x) = x^{16} + x^{15} + x^{14} + 1$$

Conventional method



EDC is generated according to ID+IED+CPR_MAI+Main data.
Thus, information of ID,IED,CPR_MAI,Main data should be prepared first before calculating EDC.

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New method

1. calculating a first EDC, which is called as Pre-EDC(PEDC), using ID, IED, CPR_MAI, which are substituted by zero, and original Main
2. calculating a second EDC, which is called as MEDC, using ID, IED, CPR_MAI, and the Main data substituted by zero.
3. calculating real EDC according to the PEDC and MEDC.

$$EDC = PEDC \wedge MEDC$$

Note1: During calculating EDC, 2060 bytes ID+IED+CPR_MAI +Main data are calculated in sequence, consuming DRAM.

Note2: During calculating MEDC, 12 bytes ID+IED+CPR_MAI are calculated, and the 2048 bytes Main data can be passed using a formula or substituted by zero in sequence. Bandwidth of accessing 2048 bytes Main data is saved, but calculation time of MEDC is not saved when substituted by zero (2060T are required when calculating one byte by one byte). DRAM bandwidth and calculation time of MEDC are saved when 2048 bytes of main data is passed by a formula. (13T (12+1) are required when calculating one byte by one byte).

Intention and occasion of using:

1. When main data is downloaded from Host to Host pipe, Host pipe calculates PEDC according to the Main data and stores the PEDC to the DRAM. During encoding, Host pipe calculates MEDC according to ID+IED+CPR_MAI, calculates EDC according to PEDC and MEDC, and stores the EDC to the DRAM. The advantages of this method are that Host pipe receives Main data without the information of the corresponding ID+IED+CPR_MAI, and Encode pipe calculates EDC by reading 12 bytes ID+IED+CPR_MAI and 4 bytes PEDC without reading all the 2060 bytes data, substantially decreasing accessing of DRAM.
2. Some specific data blocks, generally prepared by firmware, might be used repeatedly, thus the main data may be fixed but ID and IED even CPR_MAI may be different. Therefore, new EDC can be generated by calculating PEDC one time and reading corresponding ID, IED, CPR_MAI and PEDC no matter how much times the data block is repeatedly used.

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Note 3: ID, IED, CPR_MAI can be substituted by other predetermined values other than zero when calculating PEDC, and Main data can be substituted by other predetermined values other than zero when calculating MEDC.

At this time, $EDC = PEDC \wedge MEDC \wedge C$

Where C is a constant value generated according to the substituted predetermined value.

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DVD Specifications for Recordable Disc / Part 1: Physical Specifications / Version 1.0a

3. Information and

3.2 Data

3.2 Data format

The data to be stored, called the Main data, is formatted in a number of steps before being recorded on the disc. It is transformed successively into a Data frame, a Scrambled frame, an ECC block, a Recording frame, and a Physical sector.

A Data frame consists of 2048 bytes of Main data, 12 bytes of Identification Data (ID) and others, and 4 bytes of Error Detection Code (EDC).

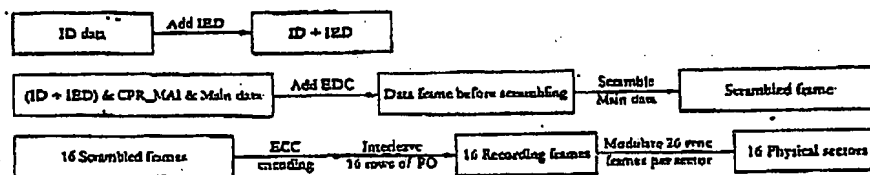
After EDC calculation, scrambling data is added to 2048 bytes of Main data in the Data frame. This becomes a Scrambled frame. Then cross Reed-Solomon Error Correction Code over 16 Scrambled frames of ECC block is encoded.

The Recording frame is the frame after ECC-encoding, and is the Scrambled frame with a supplement consisting of the outer-code parity (PO) and the inner-code parity (PI).

The PO and the PI are generated within the ECC block which is formed every 16 Scrambled frames.

The Physical sector is the sector after the 8/16 modulation conversion, which adds a SYNC code to the head of every 91 bytes in the Recording frame. The processing order is shown in [Figure 3.2-1] and described in 3.2.1.

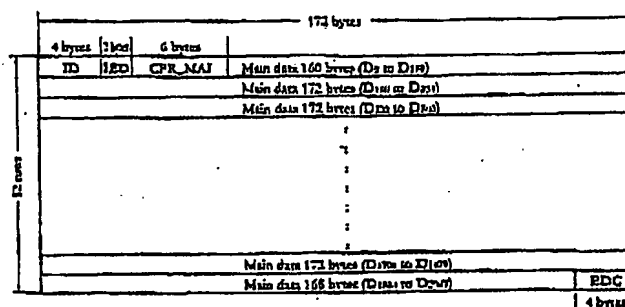
0 Figure 3.2-1: Processing order to construct the Physical sector



3.2.1 Data frame configuration

The Data frame consists of 2064 bytes, i.e. 172 bytes × 12 rows including the Main data of 2048 bytes, as shown in [Figure 3.2-1-1].

0 Figure 3.2-1-1: Data frame configuration



DVD Specifications for Recordable Disc / Part 1: Physical Specifications / Version 1.0

3. Information area format

3.1 Data format

3.2.5 Error Detection Code

EDC is a 4-byte check code attached to the 2060 bytes of a Data frame before scrambling.

In [Figure 3.2.1-1], suppose the MSB of the first byte of ID field is b_{31} and the LSB of the last byte of EDC is b_0 , then each bit b_i ($i=31$ to 0) for EDC shall be as follows:

$$\begin{aligned} \text{EDC}(x) &= \sum_{i=0}^n b_i x^i \\ &= I(x) \bmod \{g(x)\} \end{aligned}$$

where,

$$I(x) = \sum_{i=0}^n b_i x^i$$

$$g(x) = x^{32} + x^{31} + x^4 + 1$$